



Department of Kinesiology & Physical Education

EDKP 206 Biomechanics of Human Movement

General information

Term and year:	W2024	
Course pre-requisite(s):	PHYS 101 or PHYS 131	
Course co-requisite(s):		
Course schedule (class day(s) and time):		
Lectures:	Monday, 9:35-11:25	SADB 1/12
Lab (sec 2):	Monday, 11:25-13:25	Currie 304
Lab (sec 3):	Monday, 14:25-16:25	Currie 304
Lab (sec 4):	Wednesday, 14:25-16:25	Currie 304
Number of credits:	3	
Course Structure:	Lectures x 11 Labs x 12	Exams x 2

Instructor information

Name and title: Philippe C. Dixon, PhD, CSCS, Assistant Professor

E-mail: phil.dixon@mcgill.ca

Office location / office hours: Currie 204 / by appointment

Communication plan:

- For questions related to course content: please post your questions in the appropriate discussion board on mycourses
- For any other questions, please send an email with “EDKP206” in the subject field. Response time is within 48 hours (weekends & holidays excluded). Estimated response time to emails is 2 working days.

Teaching Assistants: Yiyang Chen, Andrew Philips, Cinthja Pathmanathan, Carson Graham

Graders:, Natalie Schwartz, Mayam Owrangi

Course overview

This course applies general principles of mechanics and math to analyze human movement. Students will explore the development of forces within muscles, the strength properties of bones, the variety of joint designs and resulting different rotational degrees of freedom, and how these initiate and control human movement. These concepts will be applied to understand human posture and movement mechanics along a continuum from athletic to control to pathological, and across the lifespan from child to adult to elderly.

Learning outcomes

By the end of this course, you will be able to:

- Apply fundamental principles of mechanics to solve 2D equations of human movement
- Describe the mechanical properties of bones, cartilage, ligaments, and muscles
- Describe the structure and movements of the main joints in the human body
- Conduct quantitative analysis of human movement and muscle activity

Instructional methods

This course comprises weekly lectures and laboratory sessions. Laboratory sessions provide students with the opportunity to deepen their understanding of the lecture material through problem solving sessions or hands-on experiments using biomechanical instruments. Learning activities will be synchronous and take place in person. We will use the myCourses platform for assignments/lab reports submission. See McGill's [Learning Resources](#) for instructions or tutorials to help with your learning.

Expectations for student participation

There are no grades for participation. We believe this helps create a less stressful ambiance in the classroom. To quote McGill professor Berkeley Kaite's syllabus (ENGL 385): *"There are no grades for either attendance or participation... you should want to be in class and participate in class discussion for its own sake and for your own sake..."*

Required course materials

- C. A. Oatis, Kinesiology: the mechanics and pathomechanics of human movement, 3rd ed. Baltimore: Lippincott Williams & Wilkins, 2016.
- Scientific calculator (for labs)

Optional course materials

- J. Hamill, K. Knutzen, and T. R. Derrick, Biomechanical basis of human movement, 4th edition. Philadelphia: Wolters Kluwer Health, 2015.

Evaluation

Name of assignment or exam	Due date	% of final grade
Lecture Tasks (5)	See course schedule	5 x 1% = 5%
Lab Reports (4)	See course schedule	4 x 5% = 20%
Midterm Exam (1)	TBD, Week 7	25%
Group Project (1)	See course schedule	15%
Final Exam (1)	TBD, exam period	35%

Lecture Tasks: Students will be assigned 5 tasks during lectures throughout the semester varying from discussion board posts to brief “quizzes” or short submissions, etc. for 1% of their total grade each. Tasks can be completed even if you are not in attendance. See course outline for schedule.

Lab Reports: Four reports worth 5% of your total grade each will be completed with your assigned lab groups throughout the semester based on the content of 2 weekly labs. One submitted copy per group must be submitted to myCourses.

Midterm Exam: This exam is composed of multiple-choice questions, short answers, and calculation questions intended to assess students’ learning of lecture and lab content. The midterm exam includes a combination of lab and lecture material from week 1 to week 6 of the course. The midterm exam is worth 25% of the total course grade.

Group Project: The final group project assesses the students’ understanding of key biomechanical concepts, the ability to assess existing scientific literature, and think critically to create a research question. Students will work in groups to create a biomechanical research question related to a selected topic. Students will be responsible for an oral presentation (previously recorded) as well as a live Q&A session during their scheduled class or lab time. Presentation should include literature review (including knowledge gap), research question, hypothesis, and proposed methods (including participant information, data collection procedures, rationale for biomechanical analysis methods, and limitations). Each group will also submit one brief word document listing the contributions of each individual group member to the project.

Final Exam: This exam will be comprised of multiple-choice questions, short answers, and calculation questions intended to assess students’ learning of lecture and lab content. The final exam will be a cumulative exam including a combination of lab and lecture material from the entire course with emphasis placed on week’s 8-12. The final exam is worth 35% of the total course grade.

Late Assignments: Assignments submitted after their deadline will be eligible to receive up to 80% of the original point value for the assignment. Submissions later than 1 week after the deadline will not be accepted. Lecture tasks may not be submitted late.

Grading scale

Grade	Grade Points	Numerical Scale of Grades
A	4.0	85-100%
A-	3.7	80-84%
B+	3.3	75-79%
B	3.0	70-74%
B-	2.7	65-69%
C+	2.3	60-64%
C	2.0	55-59%
D (Conditional Pass)	1.0	50-54%
F (Fail)	0	0-49%

Tentative course schedule Winter 2024

Week	Date	Topic (lecture/lab)	Tasks/assignments due prior to class
1	Jan 8	Introduction to Biomechanical Analysis	Oatis Ch. 1
	Jan 8/10	Free body diagrams: intro to force & moments (CG)	**Bring scientific calculator**
2	Jan 15	Mechanical Properties of Materials; Biomechanics of Bone; Biomechanics of Cartilage	Oatis Ch. 2,3, 5 Submit Lecture task 1 Complete Problem Bank W1 (optional)
	Jan 15/17	Free body diagrams: joint reaction forces and moments (CP)	**Bring scientific calculator**
3	Jan 22	Biomechanics of Tendons and Ligaments	Oatis Ch. 6 Complete Problem Bank W2 (optional)
	Jan 22/24	Work, Power, & Energy (AP)	
4	Jan 29	Biomechanics of Skeletal Muscle	Oatis Ch. 4 Submit Lab Report 1 (Lab W1+W2) Complete Problem Bank W3 (optional)
	Jan 29/31	Electromyography (YC)	
5	Feb 5	Hip and knee structure, function, analysis of forces during activit	Oatis Ch. 38-40 Submit Lecture task 2 Complete Problem Bank W4 (optional)
	Feb 5/7	Ground Reaction Force, Balance, Centre of Pressure (CG)	
6	Feb 12	Ankle, foot structure, function, analysis of forces	Oatis Ch. 41-43 Submit Lecture task 3 Complete Problem Bank W5 (optional)
	Feb 12/14	Midterm review	Complete Problem Bank W6 (optional)

7	Feb 19	Midterm	
	Feb 19/21	No lab	
8	Feb 26	Characteristics of Normal Gait, Inverse Dynamics, Running Mechanics	Oatis Ch. 44-46 Submit Lab Report 2 (Lab W3+W4)
	Feb 26/28	Walking/Running Gait Video Analysis & Interpreting Gait Waveforms (CP)	Complete Problem Bank W8 (optional)
Reading week March 4 – 8			
9	Mar 11	Lumbar spine structure, function, analysis of forces Normal posture and postural abnormalities	Oatis Ch. 47, 48 (try to read during week 8 so that reading break is a real break)
	Mar 11/13	Qualitative kinematic video analysis (AP)	**Download Kinovea**
10	Mar 18	Shoulder structure, function, analysis of forces Elbow structure, function, analysis of forces	Oatis Ch. 32-34 Complete Problem Bank W9 (optional)
	Mar 18/20	3D Motion Capture inertial measurement units (YC) + create groups for project	Submit Lecture task 4
11	Mar 25	Wrist & hand structure, function, analysis of forces Mechanics and patho-mechanics of pinch & grasp	Oatis Ch. 8-10 Oatis Ch. 11-13 Submit Lab Report 3 (Lab W5+W8) Complete Problem Bank W10 (optional)
	Mar 25/27	Introduce Group Project (PD, AP)	
12	Apr 1	Applications (guest lecturers TBD)	Oatis Ch. 14-16, 19 Final Exam study guide Complete Problem Bank W11 (optional)
	Apr 1/3	Group Project Prep (PD, AP)	Email finalized groups and topic to TA Submit Lecture task 5

13	Apr 8*	Group Project Viewing + Live Q&A (Mon AM Lab) (PD, AP, MO)	Submit presentation recordings Submit Lab Report 4 (Lab W9+W10)
	Apr 8/10*	Group Project Viewing & Live Q&A's (PD, AP, MO)	

McGill policy statements

- Language of submission
 “In accord with McGill University’s [Charter of Students’ Rights](#), students in this course have the right to submit in English or in French written work that is to be graded. This does not apply to courses in which acquiring proficiency in a language is one of the objectives.” (Approved by Senate on 21 January 2009)

 « Conformément à [la Charte des droits de l'étudiant](#) de l'Université McGill, chaque étudiant a le droit de soumettre en français ou en anglais tout travail écrit devant être noté, sauf dans le cas des cours dont l'un des objets est la maîtrise d'une langue. » (Énoncé approuvé par le Sénat le 21 janvier 2009)
- Academic integrity
 “McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the [Code of Student Conduct and Disciplinary Procedures](#)” (Approved by Senate on 29 January 2003) (See [McGill’s guide to academic honesty](#) for more information).

 « L'université McGill attache une haute importance à l'honnêteté académique. Il incombe par conséquent à tous les étudiants de comprendre ce que l'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir de telles actions, selon [le Code de conduite de l'étudiant et procédures disciplinaires](#). » (Énoncé approuvé par le Sénat le 29 janvier 2003) (pour de plus amples renseignements, veuillez consulter le [guide pour l'honnêteté académique de McGill](#).)

Additional statements

- Assessment: The [University Student Assessment Policy](#) exists to ensure fair and equitable academic assessment for all students and to protect students from excessive workloads.
- Basic needs: If you have difficulty affording food or if you lack a safe and stable place to live, and believe that these circumstances may affect your performance in this course, I encourage you to contact the [Dean of Students](#), who can connect you with support services. If you feel comfortable doing so, please let me know as well so we can discuss how I can best support your learning. [adapted from [Goldrick-Rab, 2017](#)].
- Charter of Students' Rights: Additional policies governing academic issues that affect students can be found in the [McGill Charter of Students' Rights](#).
- Copyright: © Instructor-generated course materials (e.g., handouts, notes, summaries, exam questions) are protected by law and may not be copied or distributed in any form or in any medium without explicit permission of the instructor. Note that copyright infringements can be subject to follow-up by the University under the Code of Student Conduct and Disciplinary Procedures.
- EDI statement: The following EDI statement, from Rona Ramos at Rona Ramos at Yale University, summarizes my thoughts on EDI in our classroom: "This class strives to be an inclusive community, learning from the many perspectives that come from having differing backgrounds and beliefs. As a community, we aim to be respectful to all. We reject all forms of prejudice and discrimination, including but not limited to those based on age, color, disability, gender, gender identity, gender expression, national origin, political affiliation, race, religion, sexual orientation, and veteran status. Faculty and students are expected to commit to creating an environment that facilitates inquiry and self-expression, while also demonstrating diligence in understanding how others' viewpoints may be different from their own."
- Extraordinary circumstances: In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.
- Inclusive learning environment: As the instructor of this course, I endeavor to provide an inclusive learning environment; however, if you experience barriers to learning in this course, do not hesitate to discuss them with me and/or [Student Accessibility and Achievement](#).

- Intellectual property: I ask for everyone's cooperation in ensuring that this course content and associated material are not reproduced or placed in the public domain. This means that each of you can use it for your own purposes, but you cannot allow others to use it by posting it online or giving it or selling it to others who may copy it and make it available. Thank you for your help with this.
- Land acknowledgement: "McGill University is on land which has long served as a site of meeting and exchange amongst Indigenous peoples, including the Haudenosaunee and Anishinabeg nations. We acknowledge and thank the diverse Indigenous peoples whose presence marks this territory on which peoples of the world now gather." See [McGill Land-acknowledgement](#) for more information.
- Learning support resources: Consult resources from [Teaching and Learning Services](#) (TLS) on topics such as time management, study strategies, group work, exam prep, and more. TLS also offers opportunities to connect with an academic peer mentor through [Stay on Track](#) and to attend workshops. For further individualized support check out the programs and resources from [Student Accessibility & Achievement](#).
- Mercury course evaluations: [Mercury course evaluations](#) are one of the ways that McGill works towards maintaining and improving the quality of courses and the student's learning experience. You will be notified by e-mail when the evaluations are available. Please note that a minimum number of responses must be received for results to be available to students.
- Mobile devices: The use of mobile computing and communications (MC2) devices must, in all cases, respect policies and regulations of the University, including in particular the following: 1. The Code of Student Conduct and Disciplinary Procedures; 2. The Policy Concerning the Rights of Students with Disabilities; 3. The Policy on the Responsible Use of McGill IT Resources. No audio or video recording of any kind is allowed in class without the explicit permission of the instructor
- Preferred pronouns: Please email me if you would like me to refer to you by a different name than the [name indicated](#) in your student record or to inform me of your preferred pronouns.
- Recording privacy: I will notify you if part of a class is being recorded. By remaining in classes that are recorded, you agree to the recording, and you understand that your image, voice, and name may be disclosed to classmates. You also understand that recordings will be made available in myCourses to students registered in the course. Please consult me if you have concerns about privacy and we can discuss possible measures that can be taken.
- Respect: The University is committed to maintaining teaching and learning spaces that are respectful and inclusive for all. To this end, offensive, violent, or harmful language arising in course contexts may be cause for disciplinary action.

- Sustainability: McGill has policies on sustainability, paper use, and other initiatives to promote a culture of sustainability at McGill. See the [Office of Sustainability](#).
- Text-matching: Work submitted for evaluation as part of this course may be checked with text-matching software within myCourses.
- Wellness: Many students may face mental health challenges that can impact not only their academic success but also their ability to thrive in our campus community. Please reach out for support when you need it; [wellness resources](#) are available on campus, off campus, and online.
- Workload management skills: If you are feeling overwhelmed by your academic work and/or would like to further develop your time and workload management skills, don't hesitate to seek support from [Student Services](#).